



Published in final edited form as:

J Infect Dis. 2014 November 01; 210(Suppl 1): S91–S97. doi:10.1093/infdis/jiu228.

An Evaluation of Polio Supplemental Immunization Activities in Kano, Katsina, and Zamfara States, Nigeria: Lessons in Progress

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Abstract

Background.—As 1 of 3 remaining poliovirus-endemic countries, Nigeria has become key to the global polio eradication effort. We evaluated supplemental immunization activities, including team performance, communications/mobilization activities, and vaccine acceptance, in 3 high-risk states.

Methods.—We used structured survey and observation instruments, document review, and stakeholder interviews.

Results.—Observations or surveys were conducted at 1697 households. Vaccine acceptance ranged from 87%–94%; among households rejecting polio vaccine, 38% of mothers sought measles vaccine for their children. Teams performed between 4%–42% of assigned tasks.

Conclusions.—Acceptance is high but teams have a critical role in surmounting residual vaccine resistance.

Keywords

eradication; evaluation; immunization; microplanning; Nigeria; outbreak; polio; social mobilization; structured observation; survey

Since the initiation of polio eradication efforts in Nigeria in 1996, annual reported polio incidence has fluctuated from a high of 1122 cases in 2006 to a low of 21 in 2010 [1, 2].

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Supplement sponsorship. This article is part of a supplement entitled “The Final Phase of Polio Eradication and Endgame Strategies for the Post-Eradication Era,” which was sponsored by the Centers for Disease Control and Prevention.

Potential conflicts of interest. All authors: No reported conflicts.

All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

These setbacks can be attributed in part to the religious fatwa issued in 2003–2004, banning the acceptance of oral polio vaccine (OPV) in Kano state, and increasing civil conflict from the Islamic militant organization Boko Haram in northeastern Nigeria [3]. Molecular typing, however, allows us to see the repercussions of these setbacks far beyond Nigeria's borders: virus of Nigerian origin was responsible for outbreaks in 25 countries, largely within Africa but as far away as Indonesia. All wild poliovirus detected in Africa outside of Nigeria since 2012 originated in Nigeria, including the wild polioviruses detected in the 2013 outbreaks in Kenya, Somalia, Cameroon, and Ethiopia (Burns C., Personal communication. 2014). Nigeria has thus become a lynchpin in global eradication efforts.

Supplemental immunization activities (SIAs) are 1 of 4 cornerstone eradication strategies, including surveillance for acute flaccid paralysis (AFP), routine immunization (RI), and “mop-up” campaigns after an outbreak. In the absence of adequate RI, SIAs are relied upon to maintain population immunity, thus their effectiveness is critical to eradication efforts. During an SIA, vaccine is distributed primarily by teams that visit every house to identify all children <5 years of age. In addition to these “house-to-house” (H2H) teams, immunization programs may also utilize temporary fixed posts (usually health centers), and “special teams,” which deliver vaccine to eligible children in areas not traditionally visited by H2H teams: markets, bus stops/transport hubs, fields, public or Islamic schools, play areas, religious settings, border posts, and so forth. Regardless of delivery strategy, an SIA's success is a function of both demand for vaccine and the ability to supply an effective dose to every eligible child.

While general acceptance for polio and measles vaccine was believed to be high even after the fatwa, poor coverage during SIAs was attributed to both supply- and demand-side factors [4]. The United Nations Children's Fund's (UNICEF's) annual immunization knowledge, attitude, and practice studies cited low confidence in vaccinators, their failure to reach all households, and low awareness of the campaigns as supply-side factors negatively affecting SIA coverage [5, 6]. On the demand side, spousal support for vaccine acceptance was cited in multiple studies as a critical issue in a country where female household heads have limited autonomy with regard to healthcare [7, 8]. UNICEF's data also indicated that although acceptance was high, demand was lower than anticipated, owing to misconceptions regarding the safety of polio vaccine. The goal of this study was to gain a detailed understanding of the household- and team-level factors associated with failure to vaccinate children <5 years of age during polio SIAs in Nigeria.

METHODS

The evaluation was conducted between 31 January and 2 February 2010 during the January SIAs in the high-risk states of Kano, Katsina, and Zamfara.

We used a purposive sampling approach to examine vaccine delivery in high-risk local government areas (LGAs). LGA selection was based on the cumulative number of wild polio virus (WPV) cases (type 1 and type 3) and circulating vaccine-derived poliovirus (cVDPV) cases during a 6-month period in 2009. Two LGAs with the greatest number of <5 WPV cases were selected in each of the 3 high-risk states. Within each LGA, 4 wards were

selected randomly, for a total of 24 wards across the 3 states. The sample was reduced to 20 wards (Zamfara, 5; Katsina, 8; and Kano, 7) to accommodate the number of indigenous language-speaking interviewers from each state who passed the training.

The study protocol was developed jointly by the US Centers for Disease Control and Prevention (CDC) and the Nigeria Primary Health Care Development Agency (NPHCDA). This activity was reviewed and determined to be a routine program evaluation rather than research and thus was exempt from Centers for Disease Control and Prevention institutional review board and human subjects research review. Verbal consent was obtained from all respondents.

The evaluation focused on vaccination team performance by team type (special, H2H, school), cold-chain operations and management (reported separately), and microplan quality. Survey instruments were developed utilizing the NPHCDA Immunization Plus Days (IPDs) implementation guidelines [9] to evaluate team performance, operational planning, and activities. All data collection tools were translated into Hausa and back-translated into English by native Hausa-speaking translators. Instruments were pilot-tested during an SIA from 21 to 23 November 2009. Survey interviewers were indigenes of Kano, Katsina, and Zamfara states, with university-level proficiency in written and spoken Hausa and English. Candidate interviewers attended a 4-day classroom and skills-based training; post-training examination results determined which interviewers were selected for the study.

Three-person interview teams (1 male and 2 females) worked in each ward for the first 3 days of the SIA in January 2010. As Hausa tradition dictates that men may not speak with or enter the household of women to whom they are unrelated by blood without the explicit permission from the male head-of-household, female interviewers either observed the vaccination teams or conducted the household (HH) survey. Male interviewers performed the cold-chain, microplan, and special-teams (including school-specific) instruments. To reduce interobserver variability, each female interviewer performed either team observations or HH follow-up interviews based on her demonstrated proficiency as an observer or interviewer.

In order to distinguish between actual and reported behavior of H2H vaccination teams, we used a dual data collection strategy. The day following the vaccination team's household visit, structured interviews were conducted with the female head of the household (FHOH). The interview focused on reported interactions with the vaccination team, FHOH's perceptions about the team's professionalism, knowledge about the campaign, and attitude toward immunization.

Trained observers evaluated actual H2H vaccination team performance by direct observation. The structured observational checklist focused on team composition, adherence to SIA training guidelines, and professionalism when interacting with HH members. Vaccination "special teams," who are tasked with vaccinating eligible children found outside the home in the market, at playgrounds, and at agricultural areas or water collection points, were also evaluated by direct observation. We also evaluated ward-level microplanning activities and communications/mobilization plans. Data were abstracted from microplans

on 3 activity types: team guidance (eg, settlement lists, target population, and OPV vial calculations), mobilization plans (eg, rosters of influencers/community leaders and schools to be contacted), and communications plans (eg, number and type of materials, distribution strategy). The accuracy and implementation of these plans were then validated via technical review, interviews with mobilization targets (eg, community/religious, teachers), and a structured community “walk-through” to document the presence of communications materials such as posters and banners.

One supervisor supported 2 ward-level interviewer teams; additional technical and supervisory support was provided by CDC and NPHCDA at the LGA level. Data-collection instruments were reviewed each night for completeness and consistency. At the end of the SIA, forms were accessioned and data-entered with CDC supervision. Analyses were conducted using SPSS versions 16.0 and 21.0.

RESULTS

FHOH Interviews

During 31 January–2 February 2010, the evaluation teams visited 884 HHs in 3 states to conduct interviews. Households were excluded if no children <5 years resided in the HH or the FHOH who met with the vaccination team the prior day was unavailable (n = 20) (Figure 1). The interview included general questions about the SIA and specific questions about the vaccination team’s activities during the HH visit on the preceding day.

Of the 864 households meeting inclusion criteria, 87% accepted OPV from the vaccinators. Nearly half (45%) of the reasons cited for OPV refusal related to the explicit disapproval of the male head of household or, in his absence, lack of permission. Other specific reasons related to dissatisfaction or trust of the healthcare system (Figure 2).

FHOHs responded to questions regarding the cultural acceptability of vaccination teams and, if the HH accepted vaccine, the teams’ accomplishment of interpersonal communication tasks (ICTs). Overall, the teams were favorably received: FHOHs reported the teams “dressed appropriately” (97%), “treated respondents well” (87%), and appeared “age-appropriate” to the task (86%) (n = 864). With regard to the performance of ICTs outlined in the IPD Guidelines and NPHCDA vaccinator training materials, the teams failed to complete most ICTs (Table 1).

Incentives (also known as “pluses”) were provided to 85% of children in HHs that accepted OPV; 100% of these were “sweets.” No mothers reported receiving other incentives. Among mothers whose child received a sweet, 41% stated that the presence of the incentive influenced their decision to vaccinate and 43% expressed preference for “better” incentives such as bednets (65%), soap (31%), vitamins, or other healthcare items (10%) (multiple responses allowed).

FHOHs were also asked questions designed to assess the effectiveness of pre-SIA communication strategies. Approximately one-half (51%) of FHOHs had prior knowledge of the SIA before the vaccinators arrived. Among FHOHs reporting any source of pre-

campaign information (n = 457), the town crier (43%), radio (32%), other community member (17%), or television (6%) were listed as their primary source of campaign information. During the SIA, only 37% of all FHOHs heard a town crier announcement and 10% or less saw any form of printed media related to the campaign (poster or banner). HHs reporting no prior knowledge of the campaign were significantly more likely to reject vaccine (18%) than HHs reporting awareness of the campaign before the vaccinators arrived (8%)(Mantel–Haenszel $P < .001$, stratified by state) [9].

Demand for measles vaccine and awareness of fixed post immunization offerings, including measles vaccine, during the SIA were also assessed. While the majority of mothers (84%) desired measles vaccine for their children, only 61% were aware that it was available at fixed posts during the polio SIA. Among noncompliant HHs, 38% of mothers still sought measles vaccine for their children. The majority of noncompliant HHs (65%), however, were not aware that measles vaccine was available during the SIA.

House-to-House Team Observations

Trained observers accompanied vaccination teams to 813 HHs to evaluate their performance. Five HHs barred the team from entering and thus HH eligibility could not be determined. Within the remaining 808 HHs, 748 (93%) met the inclusion criteria for the presence of children <5 years. Within this group, 66 HHs (9%) offered initial resistance to the vaccination teams; 24 (3%) responded favorably to efforts to assuage their concerns, while the remaining 42 (6%) remained steadfast in their refusal of OPV.

Structured observation data mirrored reports from the HH interviews: the teams were observed to be friendly (93%), respectful (97%), and appropriate in their use of Hausa greetings (94%) and handling of children (95%). Few parents (2%) questioned the need for multiple rounds or doses. Teams were observed to miss eligible children in 11% of HH. Teams marked 95% of houses after the visit, but approximately 12% of vaccinated children did not have their fingers marked by the team. Teams were also observed to mark some houses as fully vaccinated, when 1 or more children were missed, or when the house had not been entered. We are unable to quantify these actions due to irregularities with the evaluators' HH line lists; however, anecdotal reports by evaluators were consistent on this point. Consistent with FHOH reports, vaccination teams were observed to significantly underperform ICTs (Table 1).

Special Teams Observations

Special teams were comprised of a female vaccinator, a tally clerk, and an optional “mobilizer” who was supposed to sweep an area for eligible children in advance of the other team members. The evaluators observed a total of 359 location-specific special team activities. Teams were deployed to playgrounds (33%), streets (26%), markets (13%), bus stops (9%), mosques (8%), farming areas (6%), and other areas (<3%).

Special team performance indicators were consistent with the observations of H2H teams. Overall, they were well accepted (>95%), but did not consistently execute their duties, and lacked materials such as banners or noisemakers to announce their presence (Table 2). The

absence of these facilitation materials was usually attributed by ward focal persons (WFPs) and team members to “insufficient [mobilization] funds.”

Microplanning and Social Mobilization Processes

Evaluators interviewed the WFP to gain a clear understanding of the SIA planning process, WFP experience and proficiencies. Microplan quality varied widely among the 20 wards. Some plans lacked sufficient detail (eg, team identification or assignment, routes, settlement names [15%]); some plans appeared to be “recycled” from previous IPDs that had not been updated to reflect changes in target population data. WFPs were asked about the use of daily route maps (DRMs): most (80%) reported that the DRMs specified the target population and number of vials needed for each day; 45%, however, reported that the DRMs were found on the wall of the facility and do not accompany the team. Thirty percent had no means to photocopy DRMs for distribution to the teams. Five WFPs (25%) reported that the LGA Chairman had allocated funds to support additional vaccination teams; the median number of additional teams was 2. In order of priority, distant settlements, nomadic groups and noncompliant HHs posed the greatest challenge and were all considered “hard-to-reach.”

One-fourth of the WFPs did not know how to calculate the target population for OPV from the total population. Two WFPs (10%) stated that the number of OPV vials needed was equal to the target population plus a wastage factor divided by 20; only 5 (25%) stated that wastage must be included in the calculation.

The IPD Guidelines recommend that community mobilizers directly notify schools and religious institutions, use community dialogs, and engage other relevant social groups or NGOs. Across the wards, a median of 22 religious leaders, 12 traditional leaders, 4 community-based organizations, 20 Quranic schools, 7 government schools, and 3 Islamiyya schools were enumerated in community mobilization planning documents. During interviews, WFPs reported that traditional leaders were generally not listed by name for follow-up (56%); 65% of religious leaders were contacted verbally, while 20% were contacted through an unnamed intermediary. Fifty-five percent were reportedly contacted the week before the SIA; the remainder the week of the SIA. Similarly, most schools (56%) were contacted verbally/in person.

We also sought to validate additional mobilization plan elements through interviews. The evaluators interviewed 3 traditional leaders, religious leaders, and headmasters in their designated wards. Among the 60 traditional leaders interviewed, a priori knowledge of the SIA was high (98%) as was participation in SIA planning meetings (95%). Knowledge among religious leadership was slightly lower (85%); 58% participated in a preparatory meeting. Among 60 school headmasters interviewed, 75% had prior knowledge, and half reported being requested to notify parents. Interviews were conducted at Quranic (47%), Islamiyya (23%), government (23%), and other types of schools, including nursery and Christian (7%).

The written mobilization plans were validated during the SIA through follow-up interviews. To validate the implementation of the planned communications activities, evaluators conducted ward-level “man-on-the street” interviews during the SIA. Of the 400 interview

subjects, 72% were men. Seventy percent of respondents reported knowing about the SIA; there was no difference by sex or location of residence. Respondents named the following sources of information about the SIA: friends/family (28%), radio (19%), town crier (17%), other community location (10%), health center (9%), mosque (9%), or community dialogue (9%) (multiple responses allowed).

The use of print media was validated by observation in 12/20 (60%) of the wards, but the estimates were highly variable. While the planned number of posters ranged from 0 to 500 (median, 0), observations ranged from 0 to 26, although 58% of reporting wards observed no posters. Flyers and banners were only observed in 1 and 3 of 20 wards, respectively.

DISCUSSION

The following limitations should be noted. Interviewers asked mothers to recall their experience with the team from the previous day; while we believe that recall over such a short interval would be minimally affected by recall bias, given the frequency of SIAs, it's possible that mothers may have generalized impressions of the team based upon previous experiences. Although several screening questions were used to identify the FHOH who interacted with the team, there is a possibility that the team may have interviewed a co-wife, rather than the FHOH.

With respect to the structured observations, subject reactivity to observation is always a potential. Our data show that the recall of unobserved vaccination teams' behaviors mirrored observed teams' behaviors; this suggests that vaccinator behavior did not change as a result of observation. Given the vaccination teams' haste, however, observers may not have completed all forms in real time, and in doing so, they may have overlooked or generalized their own recall of some events.

The study relied upon a significant amount of qualitative data collected in text format, which can be afflicted with various forms of "information bias." Actual quotes may have been summarized by recorders or data entry clerks rather than recorded verbatim. This would result in a loss of data granularity.

Data from the HH survey interviews and vaccination team observations indicate that overall, OPV acceptance is high in northern Nigeria, although a small group of noncompliant HHs exists, consistent with previous studies [5–7]. FHOHs cited spousal resistance as the primary barrier to OPV acceptance, although overall, they did not identify specifically *why* their husbands were resistant. A minority cited fears about safety or suspicions about polio vaccine being tainted with contraceptives.

We were unable to determine the extent to which noncompliance clusters geographically. To date, it is unclear whether "block rejection" is a function of idiosyncrasy, shared social networks and influencers, or geographic proximity, although sociological principles of homophily would suggest the former. Deconstructing the mechanisms of rejection requires the Global Polio Eradication Initiative to work with traditional and local government leadership to systematically identify and line-list noncompliant HHs in "block rejection" areas and identify the most salient concerns. To develop effective and targeted interventions,

we need a more nuanced understanding of who the “noncompliant” are, and their concerns. Once the “topography” of noncompliance has been described, it is critical to understand whether resistance is amenable to traditional leadership intervention, or requires alternative mediation or educational strategies. This is a critical step, as the communications strategy for geographically clustered versus geographically diverse noncompliant HHs could be quite different.

Because of the demand for measles vaccine (even among those who reject polio vaccine), these data demonstrate that vaccine rejection is not wholesale. This is consistent with the perception that Nigerians value immunization for known killers such as measles and meningitis. Therein lies the challenge: as polio cases become rarer, polio’s saliency declines in the general public, necessitating clear communications around its seemingly incongruous prioritization compared with other childhood illnesses.

The government has an opportunity to capitalize on this demand to bring both polio-vaccine-compliant and noncompliant families into clinics during SIAs for education and for routine immunization catch-up sessions. While this requires clinics to be organized, staffed, and fully supplied with these other vaccines during SIAs and other related “push” activities, it is an opportunity that should not be overlooked. Building confidence in the system will reinforce the “routineness” of RI; conversely, stock-outs and irregularities related to other vaccines reinforce suspicion about polio and negative views of the government.

Both the observing teams and the HHs confirmed that the vaccination teams are generally accepted by community members. The teams rarely completed all of their assigned tasks, however. The vaccinators appeared to politely seek entry to homes, and then vaccinate most but not all children encountered. They did not consistently confirm the precise number of children <5 years of age, nor inquire about infants <1 year of age in each HH. Through this systematic omission, vaccinators overlooked the most vulnerable age group, and missed the opportunity to remind mothers of the need for (and availability of) routine vaccination—including measles—at fixed posts. The teams also consistently neglected to ask each HH about new AFP cases in the settlement. In this transitional period of decreasing WPV transmission, it is critical that all AFP cases are identified through this type of active surveillance.

The teams did not appear to have the interpersonal skills and willingness to overcome OPV rejection; rather than engage and educate, most delegated resistant households to a supervisor. Teams were rarely observed to explain the benefits of vaccination or allay fears. Part of this unwillingness to challenge rejection may have been attributable to gender and age differences between the vaccinators and a particular parent. For example, special teams at times were comprised wholly of teenage boys who are unable—by dint of cultural norms—to engage with young mothers. In other contexts, some female vaccinators, though married, were quite young (eg, 14 years old), and as age-deference is a cultural norm, it can be quite difficult for young female vaccinators to counter resistance successfully.

The impact of special teams was difficult to assess. Many missed opportunities for vaccination were observed. The deployment of special teams did not appear to be strategic;

most were assigned to cover “streets” and “playgrounds” that (excepting schoolyard playgrounds) refer to open areas where children congregate to play. More specific guidance is badly needed.

Although it was difficult to differentiate high-performing from low-performing teams, we believe that overall team performance can be improved by a combination of enhanced training to improve communication skills and motivation. Although we did not systematically collect data on worker satisfaction, we heard first-hand complaints of low pay, long hours, and lengthy routes, and observed that morale and motivation were low. Teams hurried to dispense vaccine, with little thought to verifying the completion of a route or catchment area, or replenishing OPV if they ran out. The determination to reach “every last child” was not evident as most teams considered the work day complete when they exhausted their vaccine supply.

Given the human and financial resources committed to communications and community mobilization, it appears that communications and mobilization strategies were insufficient to raise awareness about, provide a rationale for continuing campaigns, and overcome resistance (which was above 10% across the 3 states). While the majority of HHs reported vaccine acceptance, the communication strategies did not reach all community members, although print media, radio, and town criers were all deployed. Man-on-the street interviews indicated that 70% of male respondents knew about the campaign. Men predominantly attributed their awareness to person-to-person communication modalities such as friends/family and mosque or community dialogues. The success of gender-specific modalities suggests that opportunities to also target messages regarding trust and noncompliance toward men could be fruitful.

Although nearly half of FHOHs did *not* hear about the SIA in advance, they accepted vaccine anyway; this suggests that overall acceptance is high even without reminders. Noncompliant HHs were 2.5 times more likely to experience a communications “vacuum” than HHs that accepted vaccine. It is unclear whether this is a function of media reach, geographic proximity to media, self-selection, or confounding of education or income with access to media (ie, town centers with wealthier, more educated families with radio/television). Nonetheless, it raises the question of whether it is more strategic to focus resources primarily on noncompliant groups rather than the general population.

While most of the community leaders we interviewed confirmed that they had been contacted, it was not clear whether contact resulted in action (ie, that religious or traditional leaders held or attended meetings, or that schools sent out additional notices to parents). To maximize the impact of the mobilization activities, community mobilizers require clear terms of reference, management training, and logistical and financial support to fully engage and follow-up in an actionable manner with community leadership.

Based on document reviews and interviews, microplanning activities required strengthening. These processes appeared to be poorly understood, and therefore treated in a perfunctory fashion. This was evident through a visible lack of preparedness, as well as the recycling of planning data from previous SIAs. In addition to having a negative effect on morale,

the completion of what is perceived to be busy-work squanders resources. Knowledge gaps, such as those around wastage calculations, have the potential to result in thousands of missed children per round, and can be addressed through refresher trainings. Similarly, the absence of a systematic process to maintain current line-lists of permanent as well as seasonal settlements hinders planning, and thus nomadic populations may be overlooked. Innovative strategies (such as the use of markets and animal vaccination posts as alternative immunization venues) to engage nomadic populations have been successfully piloted in Chad and other areas, and are equally relevant to Nigeria's predominantly Fulani nomadic populations [10].

CONCLUSION

Since the dissemination of these results in 2011, NPHCDA has developed a number of strategies to address these challenges. These include the establishment of N-STOP (Nigeria Stop Transmission of Polio program) [11], a comprehensive strategy to address nomadic populations [12], expanded training for vaccinators and the use of geographic information systems to locate remote settlements and monitor vaccinator performance [13]. Like the poliovirus, the lessons from this evaluation extend far beyond Nigeria's borders. While the 4 cornerstone strategies of polio eradication remain, we must endeavor to critically examine how effectively these strategies are implemented and where there are opportunities to innovate in country-specific ways so that outbreak and endemic countries alike can learn from one another.

Acknowledgments.

The Centers for Disease Control and Prevention, the World Health Organization, and the National Primary Health Care Agency of Nigeria acknowledge the important contributions of the late engineer Musa Ali (World Health Organization, Kano Nigeria), without whom this work would not have been possible. We thank the field staff from the World Health Organization, UNICEF, and the National Primary Health Care Agency of Nigeria who provided support during the project, Ms Alison Walker for her assistance with the pilot, and Drs Kathleen Wannemuehler and Howard Gary for statistical and editorial assistance.

Financial support.

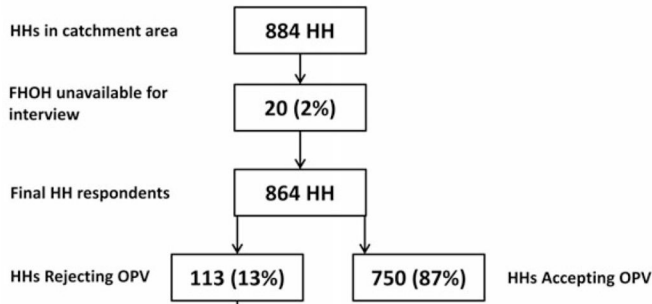
This work was supported by the Centers for Disease Control and Prevention (CDC).

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Household (HH) Interviews



Reasons provided for OPV rejection (n=86)	
Father disapproves/ not present	45%
Safety/ "trust"	9%
Knowledge	8%
Religious beliefs	5%

Structured Household (HH) Observations

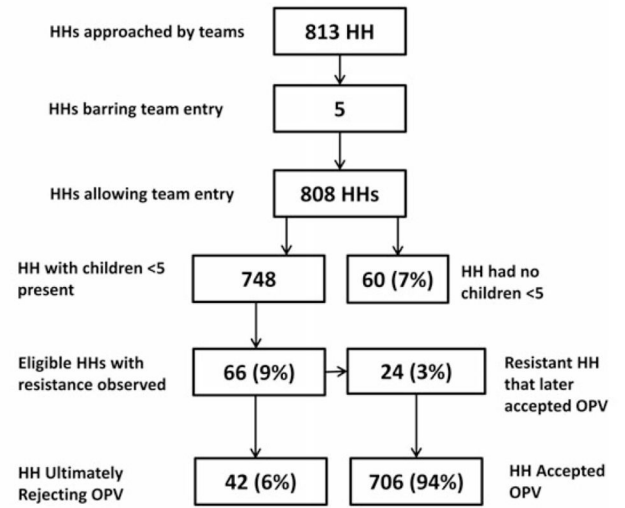


Figure 1. Sample sizes for HH interviews and structured observations. Abbreviations: HH, household; OPV, oral polio vaccine.

The Government doesn't provide anything for [us] in the health centre, why polio?

I like paracetamol more than OPV.

If she carried her children to the health centre they don't receive anything. Nobody help them with drugs whenever they are sick. They have to travel far before they get treatment.

I heard it contains some contraceptives.

There are too many doses, my child has had enough, I don't trust them anymore.

Figure 2.

Reasons given for rejection of OPV. Abbreviation: OPV, oral polio vaccine.

Table 1.

Team Interpersonal Communication Tasks Reported and Observed

Team Interpersonal Communication Tasks Reported by FHOH (n = 727)	%	Team Interpersonal Communication Tasks Observed (n = 748)	%
Confirmed the number of <5 s in HH	29	Confirmed the number of <5 s in HH	42
Confirmed the number of <1 s in HH	20	Confirmed the number of <1 s in HH	25
Inquired if any <1 up-to-date with RI schedule	17	Inquired if any <1 up-to-date with RI schedule	NA
Suggested visiting a fixed post for RI	14	Suggested visiting a fixed post for RI	15
Inquired about AFP cases in the area	7	Inquired about AFP cases in the area	4

Abbreviations: AFP, acute flaccid paralysis; FHOH, female head of the household; HH, household; RI, routine immunization; <5 s, children less than 5 years.

Table 2.

Special Team Performance Indicators

Special Team Performance Metrics (N = 359)	%
Approached all eligible children	86
Vaccinated all eligible children	72
Checked children encountered for finger ink	83
Approached mothers with infants on their backs (typically <1 y)	82
Carried a route map	54
Carried noisemaker/banner	46/14
Responses to parental resistance	
Discussed courteously	37
Did nothing/moved on	33
Called for traditional leader	18
Called for another influential person (supervisor)	9

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